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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/518,709	03/03/2000	Takahisa Yamaha	P/2171-180	5749

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EXAMINER

ORTIZ, EDGARDO

ART UNIT PAPER NUMBER

2815

DATE MAILED: 09/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/518,709

Applicant(s)
Yamaha

Examiner
Edgardo Ortiz

Art Unit
2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Jun 18, 2003
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-28 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14, 16-19, and 21-28 is/are rejected.
- 7) ☒ Claim(s) 15 and 20 is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other:

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DETAILED ACTION

This Office Action is in response to a request for continued prosecution and amendment filed June 18, 2003 on which Applicant amended claim 14.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 14, 16 and 21 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Mine et.al. (U.S. Patent No. 5,370,904). With regard to claim 14, Jung teaches a semiconductor substrate (1), a MOS type transistor formed on said semiconductor substrate, said MOS transistor including a source (3), a gate (7) and a drain (4), an interlayer insulating film (11) formed on the semiconductor substrate, said interlayer insulating film covering said MOS transistor and including a hydrogen resident film wherein hydrogen is generated in the interlayer insulating film and is diffused into the fundamental structure of the transistor (column 3, lines 8-11), a wiring layer (8, 9) formed on said interlayer insulating film and a hydrogen transmission preventing film (12) covering the MOS transistor. Regarding the

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claimed percentage of Si-H residue, Jung discloses that this ratio can be modified by a heat treatment process in order to obtain the desired percentage.

However, Jung fails to teach that the interlayer insulating film consists of silicon oxide. Mine discloses a method for the formation of silicon oxide films which includes an insulating film consisting of silicon oxide and having a silicon-bonded hydrogen content within the insulating film consisting of silicon oxide of 80% or less. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung to include an interlayer insulating film consisting of silicon oxide, as suggested by Mine, in order to provide a crack-free and pinhole-free thick silicon oxide film that could function as an interlevel dielectric layer (column 2, lines 8-11).

With regard to Claim 16, Jung teaches a hydrogen transmission preventing film (12) that includes silicon nitride (SiN:H).

With regard to Claim 21, Jung teaches a hydrogen supply path for supplying the channel region (5) of the MOS transistor that is formed between the channel region and the hydrogen resident film (11), see figure 2.

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Claims 17 and 18 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Mine et.al. (U.S. Patent No. 5,370,904) and further in view of Takahisa et.al. (Japanese Patent No. 08-222633). With regard to Claims 17 and 18, Jung and Mine essentially disclose the claimed invention but fail to show a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN. Takahisa teaches a wiring layer (19) having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cu/TiN. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung and Mine to include a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN, as clearly suggested by Takahisa, in order to prevent hot carrier deterioration due to moisture and reduce interface state density.

Claim 19 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Mine et.al. (U.S. Patent No. 5,370,904) and further in view of Applicant's admitted prior art as shown on figure 6 and its description on page 4, lines 10-15. Jung teaches a semiconductor substrate (1), a MOS type transistor formed on said semiconductor substrate, said MOS transistor including a source (3), a gate (7) and a drain (4), an interlayer insulating film (11) formed on the semiconductor substrate, said interlayer insulating film covering said MOS transistor and including a hydrogen resident film, a wiring layer (8, 9) formed on said interlayer

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insulating film and a hydrogen transmission preventing film (12) covering the MOS transistor and said wiring layer.

However, Jung and Mine fail to teach that the hydrogen transmission preventing film forms an air filled groove between adjacent wiring layers. Applicant's admitted prior art teaches a silicon nitride layer (3) that forms a groove (GV) which is filled with air having a dielectric constant of 1. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung and Mine to include a hydrogen transmission preventing film forms an air filled groove between adjacent wiring layers, as clearly suggested by Applicant's admitted prior art, in order to reduce wiring capacitance.

Claims 22, 24, 27 and 28 are rejected under 35 U.S.C. 103 (a) as being unpatentable Jung (U.S. Patent No. 5,674,759) in view of Mine et.al. (U.S. Patent No. 5,370,904) and further in view Bai et.al. (U.S. Patent No. 5,861,340). Jung teaches a semiconductor substrate (1), a MOS transistor having a gate insulating film (6), a silicon gate electrode (7) formed on the gate insulating film, source/drain regions (3, 4), formed on the silicon substrate on both sides of the silicon gate electrode, an interlayer insulating film (11) formed on the semiconductor substrate, covering said MOS transistor and including a hydrogen containing film, a wiring layer (8, 9) formed on said interlayer insulating film and a hydrogen shielding layer (12) formed on the interlayer insulating film, covering the MOS transistor and the wiring layer.

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However, Jung and Mine fail to teach silicide layers formed on the silicon gate and source/drain regions. Bai teaches a semiconductor device including a MOS transistor having a silicon gate electrode (204), source/drain regions (216) and silicide layers (220) on the silicon gate electrode and the source/drain regions. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung and Mine to include silicide layers formed on the silicon gate electrode and the source/drain regions, as clearly suggested by Bai, in order to reduce the resistance of the gate electrode and source/drain regions (column 1, lines 34-41).

With regard to Claim 24, Jung teaches a hydrogen shielding layer (12) that includes silicon nitride (SiN:H).

With regard to Claim 27, Jung teaches a wiring layer that includes a plurality (8, 9) of wiring patterns and the hydrogen shielding layer (12) forms recessed surfaces between adjacent ones of the wiring patterns, see figure 2.

With regard to Claim 28, Jung teaches a interlayer insulating film (11) that constitutes a hydrogen supply path between the hydrogen-containing film and the silicon substrate (1) under the gate insulating film (6).

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Claims 25 and 26 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Mine et.al. (U.S. Patent No. 5,370,904) and further in view Bai et.al. (U.S. Patent No. 5,861,340) and Takahisa et.al. (Japanese Patent No. 08-222633). Jung, Mine and Bai essentially disclose the claimed invention but fails to show, a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN. Takahisa teaches a wiring layer (19) having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cu/TiN. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung, Mine and Bai to include a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN, as clearly suggested by Takahisa, in order to prevent hot carrier deterioration due to moisture and reduce interface state density.

Allowable Subject Matter

2. Claims 15 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art of record fails to teach, disclose, or suggest, either alone or in combination, the claimed “*hydrogen resident film containing hydrogen silsequioxane resin*”.

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Response to Arguments

3. Applicant's arguments with respect to claims 14, 16-19 and 21-28 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Edgardo Ortiz (Art Unit 2815), whose telephone number is (703) 308-6183 or by fax at (703) 308-7724. In case the Examiner can not be reached by a direct telephone call, you might call Supervisor Eddie Lee at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application should be directed to the Group 2800 receptionist whose telephone number is (703) 308-0956.

EO / AU 2815

8/21/03


GEORGE ECKERT
PRIMARY EXAMINER